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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/689,646	10/22/2003	Tohru Saitoh	61352-049	4050

7590 12/10/2004

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EXAMINER	
NADAV, ORI	

ART UNIT	PAPER NUMBER
2811	

DATE MAILED: 12/10/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/689,646	SAITOH ET AL.	
	Examiner	Art Unit	
	ori nadav	2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 August 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-11* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *22 October 2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *10/22/03*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Specification

The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

Drawings

Figure 17 should be designated by a legend such as –Prior Art– because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.121(d)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Figures 6 and 16 were received on 8/23/2004. These drawings are approved by the examiner.

Information Disclosure Statement

The information disclosure statement filed 10/22/2003 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each foreign patent; each publication

or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. It has been placed in the application file, but the information referred to therein has not been considered.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> **The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.**

Claims 2-3 and 9-11 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The claimed limitations of a second semiconductor layer includes a region having a germanium composition ratio that varies stepwisely with a difference of 2.5% or more, as recited in claims 2-3, are unclear as to how only one region can have a germanium composition ratio that varies stepwisely with a difference of 2.5% or more, since the second semiconductor layer comprises a plurality of regions each having a germanium composition ratio that vary stepwisely with a difference of 2.5% or more.

The claimed limitations "are detected by using a speçtroscopic ellipsometer", as recited in claim 9, are unclear as to which elements are detected.

The claimed limitations "to define a distance between the first boundary and the second boundary as the thickness of the second semiconductor layer", as recited in claim 9, are unclear as to what defines the distance.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-3 and 5-11, insofar as in compliance with 35 U.S.C. 112, are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant Admitted Prior Art (AAPA) in view of Luy et al. (6,255,674).

AAPA teaches in figure 17 and related text a hetero bipolar transistor comprising

a semiconductor substrate 100;

a first semiconductor layer formed on the semiconductor substrate and comprised of a crystal containing silicon and germanium;

a second semiconductor layer formed on the first semiconductor layer and comprised of a crystal containing silicon and germanium, at least a portion of the second semiconductor layer functioning as a base layer; and

a third semiconductor layer formed on the second semiconductor layer and comprised of a crystal containing silicon, at least a portion of the third semiconductor layer functioning as an emitter layer,

AAPA does not teach the second semiconductor layer includes regions each having a germanium composition ratio that varies stepwisely with a difference of 2.5% or more, in the vicinity of a boundary between the first semiconductor layer and the second

semiconductor layer and a boundary between the second semiconductor layer and the third semiconductor layer.

Luy et al. teach in figure 3 and related text a second semiconductor layer 2 includes regions each having a germanium composition ratio that varies stepwisely with a difference of 2.5% or more, in the vicinity of a boundary between the first semiconductor layer and the second semiconductor layer and a boundary between the second semiconductor layer and the third semiconductor layer.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a second semiconductor layer includes region or regions each having a germanium composition ratio that varies stepwisely with a difference of 2.5% or more, in the vicinity of a boundary between the first semiconductor layer and the second semiconductor layer and a boundary between the second semiconductor layer and the third semiconductor layer, as taught by Luy et al., in AAPA's device in order to improve the characteristics of the device by reducing the resistance of the base layer. The combination is motivated by the teachings of Luy et al. who point out the advantages of using an HBT having a base layer including regions each having a germanium composition ratio that varies stepwise with a difference of 2.5% or more.

Regarding claim 5, Luy et al. teach a second semiconductor layer is comprised of a plurality of sub-layers having different germanium composition ratios, and the number of the sub-layers is not less than 2 and not more than 6.

Regarding claims 6 and 7, AAPA teaches a marker layer formed between the first semiconductor layer and the second semiconductor layer and between the second semiconductor layer and the third semiconductor layer, wherein the marker layer has a germanium composition ratio higher or lower than a germanium composition ratio of the first and third semiconductor layer of prior art's device by 2.5% or more and is comprised of a crystal containing at least silicon and germanium, respectively.

Regarding claim 8, Luy et al. teach a second semiconductor layer includes regions each having a bandgap that varies stepwisely with a difference of 18 meV or more, in the vicinity of a boundary between the first semiconductor layer and the second semiconductor layer and a boundary between the second semiconductor layer and the third semiconductor layer.

Regarding claim 9, Luy et al. teach a second semiconductor layer is comprised of a plurality of sub-layers, a composition ratio of germanium contained in a first sub-layer is different from a composition ratio of germanium contained in a second sub-layer adjacent to the first sub-layer, and a first boundary between the first semiconductor layer and a sub-layer of the second semiconductor layer which is adjacent to the first semiconductor layer, where the composition ratio of germanium varies discontinuously, and a second boundary between the third semiconductor layer and a sub-layer of the second semiconductor layer which is adjacent to the third semiconductor layer, where composition ratio of germanium varies discontinuously to define a distance between the

first boundary and the second boundary as the thickness of the second semiconductor layer. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a speçtroscopic ellipsometer to measure the thickness of the second semiconductor layer in AAPA's device in order to build the device with better accuracy.

Regarding claim 10, Luy et al. teach each of the plurality of sub-layers contains germanium of a composition ratio of 1.5 % or more, and a difference in composition ratio between the germanium contained in the first sub-layer and a composition ratio of the germanium contained in the second sub-layer is 1.5 % or more.

Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over AAPA and Luy et al. as applied to claim 1 above, and further in view of Chu et al. (6,750,119). AAPA and Luy et al. teach substantially the entire claimed structure, as applied to claim 1 above, except a second semiconductor layer contains silicon, germanium, and carbon.

Chu et al. teach a second semiconductor base layer contains silicon, germanium, and carbon (column 1, lines 19-40). It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a second semiconductor layer contains silicon, germanium, and carbon, in the devices of AAPA and Luy et al. in order to improve the device characteristics by suppressing boron outdiffusion.

Papers related to this application may be submitted to Technology center (TC) 2800 by facsimile transmission. Papers should be faxed to TC 2800 via the TC 2800 Fax center located in Crystal Plaza 4, room 4-C23. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG 30 (November 15, 1989). The Group 2811 Fax Center number is (703) 308-7722 and 308-7724. The Group 2811 Fax Center is to be used only for papers related to Group 2811 applications.

Any inquiry concerning this communication or any earlier communication from the Examiner should be directed to *Examiner Nadav* whose telephone number is **(571) 272-1660**. The Examiner is in the Office generally between the hours of 7 AM to 4 PM (Eastern Standard Time) Monday through Friday.

Any inquiry of a general nature or relating to the status of this application should be directed to the **Technology Center Receptionists** whose telephone number is **308-0956**

O.N.
12/6/04

ORI NADAV
PRIMARY EXAMINER
TECHNOLOGY CENTER 2800